



## THE DELICACIES OF FARM LIFE

the lab that is not so fondly referred to as "grasshoppers"



### Objective

You will be expected to:

- Calculate and compare human food needs at different trophic levels, using the data to construct a biomass pyramid.
- Analyze the benefits and drawbacks of eating at lower trophic levels on a global scale.

### Background

A **trophic level**, or feeding level, is made up of all the organisms whose energy source is the same number of consumption steps from the sun in a given ecosystem. The trophic level of plants (producers) is 1, while that of herbivores is 2, and that of animals that eat herbivores is 3. Higher trophic levels can exist for animals even higher on the food chain. In this exercise, you will compute numerical values for human energy needs based on diets at different trophic levels.

### Problem

The owner of a soybean farm raises guinea hens for food and insect control. Guinea hens will eat grasshoppers and other insect pests, including ticks. They also act as a "watchdog" by making a lot of noise when intruders approach their territory. The farmer allows the hens free range in his fields during the day and provides roosts for them at night.

***For purposes of the following exercises, make the following assumptions:***

- the farmer lives on 1 guinea hen per day for a year
- 1 hen eats 25 grasshoppers per day
- 1,000 grasshoppers have a mass of 1 kilogram
- 1 grasshopper requires about 30 grams of soy per year
- 1 human requires about 600 grasshoppers per day
- dry soybeans contain about 3.3 calories per gram
- the average guinea hen weighs about 1.7 kilograms
- the average human weighs about 60 kilograms

**Calculations:** You may (or should I say MUST) use a calculator!!

***Do the following calculations on a separate piece of paper.***

***For each calculation:***

***(a) include the question number, and identify the calculation.***

***example: Calculation #1: Number of grasshoppers per hen per year =***

***(b) show all of your work.***

***(c) make sure to include the proper units.***

***(d) “box” your final answer.***

- 1) Calculate the number of grasshoppers a hen needs per year.
- 2) How many grasshoppers are needed for a year's supply of guinea hens for the farmer each year?
- 3) What is the total mass, in kilograms, of grasshoppers needed to feed all of the hens for one year?
- 4) How many kilograms of soybeans are needed to feed all of the grasshoppers for one year?
- 5) How many humans could be fed for a year by the same amount of grasshoppers it takes to feed the guinea hens for a year?
- 6) The farmer needs to consume 3,000 calories per day. If he ate only soybeans instead of hens (or grasshoppers!), how many people would his soybean crop feed? (Hint: See your response to Question 4)
- 7) Draw a Biomass Pyramid, using the data you have developed to this point.
- 8) Draw a biomass pyramid showing the hypothetical scenario of humans feeding on the first trophic level (soybeans). (As in Question 6)

**Analysis Questions (include with your calculations)**

- 1) Why do most food chains not have a fourth or fifth level?
- 2) Should people generally eat at a lower trophic level? It seems, by simple analysis, that the Earth could support many more people if we all ate at a lower trophic level.
  - a) Outline two “pros” and two “cons” of such a practice.
  - b) On average, cows produce 19 kilograms of protein per acre per year. Soy produces 200 kilograms of protein per acre per year. Relate this data to the fact that people in less-developed countries usually eat at lower trophic levels than those in developed countries.
- 3) To what do you attribute the success of omnivores, such as coyotes, rats, and humans?